UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OFFICE OF
PREVENTION, PESTICIDES AND
TOXIC SUBSTANCES

Note to Reader

Background: As part of its effort to involve the public in the implementation of the Food Quality Protection Act of 1996 (FQPA), which is designed to ensure that the United States continues to have the safest and most abundant food supply, EPA is undertaking an effort to open public dockets on the organophosphate pesticides. These dockets will make available to all interested parties documents that were developed as part of the U.S. Environmental Protection Agency's process for making reregistration eligibility decisions and tolerance reassessments consistent with FQPA. The dockets include preliminary health assessments and, where available, ecological risk assessments conducted by EPA, rebuttals or corrections to the risk assessments submitted by chemical registrants, and the Agency's response to the registrants' submissions.

The analyses contained in this docket are preliminary in nature and represent the information available to EPA at the time they were prepared. Additional information may have been submitted to EPA which has not yet been incorporated into these analyses, and registrants or others may be developing relevant information. It's common and appropriate that new information and analyses will be used to revise and refine the evaluations contained in these dockets to make them more comprehensive and realistic. The Agency cautions against premature conclusions based on these preliminary assessments and against any use of information contained in these documents out of their full context. Throughout this process, if unacceptable risks are identified, EPA will act to reduce or eliminate the risks.

There is a 60 day comment period in which the public and all interested parties are invited to submit comments on the information in this docket. Comments should directly relate to this organophosphate and to the information and issues available in the information in this docket. Once the comment period closes, EPA will review all comments and revise the risk assessments, as necessary.

These preliminary risk assessments represent an early stage in the process by which EPA is evaluating the regulatory requirements applicable to existing pesticides. Through this opportunity for notice and comment, the Agency hopes to advance the openness and scientific soundness underpinning its decisions. This process is designed to assure that America continues to enjoy the safest and most abundant food supply. Through implementation of EPA's tolerance reassessment program under the Food Quality Protection Act, the food supply will become even safer. Leading health experts recommend that all people eat a wide variety of foods, including at least five servings of fruits and vegetables a day.

Note: This sheet is provided to help the reader understand how refined and developed the pesticide file is as of the date prepared, what if any changes have occurred recently, and what new information, if any, is expected to be included in the analysis before decisions are made. **It is not meant to be a summary of all current information regarding the chemical.** Rather, the sheet provides some context to better understand the substantive material in the docket (RED chapters, registrant rebuttals, Agency responses to rebuttals, etc.) for this pesticide.

Further, in some cases, differences may be noted between the RED chapters and the Agency's comprehensive reports on the hazard identification information and safety factors for all organophosphates. In these cases, information in the comprehensive reports is the most current and will, barring the submission of more data that the Agency finds useful, be used in the risk assessments.

Jack E. Housenger, Acting Director
Special Review and Reregistration Division

March 2, 1998

MEMORANDUM

SUBJECT: OCCUPATIONAL AND RESIDENTIAL EXPOSURE ASSESSMENT AND RECOMMENDATIONS FOR THE REREGISTRATION ELIGIBILITY DECISION DOCUMENT FOR METHYL PARATHION

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THRU: Alan Nielsen, Senior Scientist
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Please find attached the occupational and residential exposure assessment for methyl parathion.

DB Barcode: D239744

Pesticide Chemical Codes: 053501

EPA Reg Nos: 279-2149, 279-2609, 2935-142, 2935-363, 2935-421, 2935-482, 2935-527, 2935-528, 3125-35, 4581-292, 4787-4, 4787-11, 4787-18, 4787-19, 4787-22, 4787-28, 5481-175, 5481-307, 5481-330, 5481-437, 5905-55, 5905-198, 5905-414, 5905-515, 5905-528, 8660-29, 9779-34, 9779-153, 9779-207, 9779-218, 9779-323, 9779-344, 10107-39, 10163-2, 10163-7, 10163-73, 10163-118, 10163-121, 10163-162, 10163-178, 19713-37, 19713-234, 19713-256, 19713-281, 19713-322, 19713-324, 34704-10, 34704-94, 34704-433, 34704-715, 34704-794, 34704-795, 34704-796, 51036-18, 51036-42, 51036-88, 51036-278, 51036-284, 67760-29.

EPA MRID No.: N/A

PHED: Yes, Version 1.1

OCCUPATIONAL AND RESIDENTIAL EXPOSURE CHAPTER

In this document, which is for use in EPA's development of the Methyl Parathion Reregistration Eligibility Decision Document (RED), EPA presents the results of its review of the potential human health effects of occupational and residential exposure to methyl parathion.

(RED SECTION III - TOXICITY, EXPOSURE, AND RISK)

(EXPOSURE)

Occupational and Residential

An occupational and/or residential exposure assessment is required for an active ingredient if (1) certain toxicological criteria are triggered and (2) there is potential exposure to handlers (mixers, loaders, applicators, etc.) during use or to persons entering treated sites after application is complete.

Use Summary

Use Patterns

Methyl parathion, O, O-Dimethyl O-(4-nitrophenyl) phosphorothioate, is an acaricide and an insecticide registered for use on a variety of food crops. Methyl parathion, a restriced use pesticide, is formulated as a granular (0.2 percent active ingredient), a microencapsulate (20.9 percent active ingredient), and in an emulsifiable concentrate (ranges from 11.2 to 70.74 percent active ingredient).[1] Methyl parathion is formulated with several other active ingredients including malathion, endosulfan, ethyl parathion, and permethrin.

Methyl parathion can be applied with aerial equipment, airblast sprayer, chemigation, groundboom, and tractor-drawn granular spreaders. Application rates vary from 0.1 to 3 pounds active ingredient per acre depending upon the application scenario. Methyl parathion can be applied to the following crops/areas:[1,2]

Food, Forage, Feed and Fiber Crops: Alfalfa, artichoke, barley, beans, beets, broccoli, brussel sprouts, cabbage, carrot, cauliflower, celery, clover, collards, corn, cotton, cucumber, gooseberry, grass forage/fodder/hay, hops, kale, kohrabi, lentils, lettuce, mustard, oats, onion, pastures, peas, pecan, pepper, potato, rangeland, rape, rice, rutabaga, rye, safflower, sorghum, soybeans, spinach, sugar beet, sunflower, sweet potato, tobacco, tomato, turnip, vetch, wheat, yam.[1,2]

Fruits and Nuts: Almond, apple, apricot, cherry, grapes, nectarine, peach, pear, plum, and prune.

Ornamental Plants and Forest Trees: Christmas tree plantations, forest trees, ornamental and/or shade trees, field-grown ornamental herbaceous plants, field-grown ornamental woody shrubs and vines, and agricultural rights of way.[1,2]

Nonagriculture Land, Pastures, and Rice (applied for mosquito control)

Occupational-use Products and Homeowner Use Products

At this time, products containing methyl parathion are intended for occupational uses. Methyl parathion is a restricted-use pesticide and is only available for retail sale to and for use by certified applicators (or persons under their direct supervision) and only for those uses covered by the certified applicator's certification.[1] There are no residential uses either by commercial applicators or homeowners.

Summary of Toxicity Concerns Impacting Occupational and Residential Exposures

Acute Toxicology Categories

The toxicological data base for methyl parathion is adequate and will support reregistration. Guideline studies for acute toxicity indicate that the technical grade of methyl parathion classified as category I for acute oral toxicity, category I for acute dermal toxicity, category I for inhalation toxicity, category III for primary eye irritation, and category IV for primary skin irritation. Methyl parathion is not classified as a dermal sensitizer.[3]

Toxicological Endpoints of Concern

The methyl parathion hazard identification committee report, dated September 25, 1997, indicates that there are toxicological endpoints of concern for methyl parathion. Dermal endpoints of concern have been identified for short-term and intermediate-term dermal exposures in humans. A short-term dermal NOEL of 0.025 mg/kg/day for rats was based on an acute feeding study using neurotoxicity and cholinesterase inhibition as the established toxic endpoint. In addition, an intermediate-term dermal NOEL of 0.02 mg/kg/day was established from a two year chronic feeding study based on the systemic toxicity, neuropathology, and RBC cholinesterase inhibition. As no dermal absorption study was available, the default value of 100 percent was used.

An inhalation endpoint was also required for methyl parathion. Because an inhalation study was lacking, the exposure was converted to an oral equivalent dose based on a two year chronic feeding study of methyl parathion in rats. A NOEL of 0.02 mg/kg/day was identified based on systemic toxicity, neuropathology, and RBC cholinesterase inhibition. Inhalation absorption is assumed to be 100 percent.

An uncertainty factor (UF) of 100 was applied to account for both interspecies extrapolation and intraspecies variability. An additional factor of 10X was retained in accordance with the FQPA. This is justified because toxicity studies demonstrate neuropathology at relatively low dose levels and because evidence of developmental neurotoxic potential was seen in open literature studies. Because of this committee recommendation, an MOE of 1,000 is used in this risk assessment.

Since both the intermediate-term dermal NOEL and inhalation NOELs were based on identical endpoints and were based on the same chronic feeding study, the doses were combined for this risk assessment to identify a total MOE.

Epidemiological Information

Incident reports for methyl parathion were extracted from four databases with the following results:

OPP Incident Data System (IDS): Twelve anecdotal or alleged incidents were reported in IDS.

Poison Control Centers(PCC) -- Occupational and Non-occupational Exposure: 274 methyl parathion cases were recorded in the PCC database from 1985 through 1992. Of these, 102 cases resulted from occupational exposure (91 involved exposure to methyl parathion alone) and 146 cases resulted from non-occupational exposure (133 involved exposure to methyl parathion alone). Including exposure to multiple chemicals, methyl parathion had the fifth highest percent of occupational cases seen in a health care facility. On other measures of hazard (percent hospitalized, percent with symptoms or life-threatening symptoms) methyl parathion had results similar to the median for other cholinesterase inhibitors.

Poison Control Centers(PCC) -- California Data for Ratio of Poisoning to Number of Applications: Methyl parathion had very low ratios of handler and field worker poisonings per 1,000 applications in California from 1982 through 1989. Only two pesticides (*Bacillus thuringiensis* and permethrin) had lower ratios.

Poison Control Centers(PCC) -- Ratios of Poisoning based on U.S. Poison Control Data: Among pesticides used exclusively in agriculture, methyl parathion had the third lowest ratio of exposures, poisonings, and treatment to estimated pounds of active ingredient used. It also had the second lowest ratio of hospitalized cases per estimated pounds used.

Poison Control Centers(PCC) -- Exposure in Children: For methyl parathion, 26 incidents were reported in children under five years of age from 1985-1992. No further analyses were conducted.

California Department of Food and Agriculture (1982 through 1995): Methyl parathion ranked 90th as a cause of systemic poisonings in California. It was the sole active ingredient in seven of the 18 reported cases. Workers took from two to five days off work as a result of their illness.

National Pesticide Telecommunications Network (NPTN): Methyl parathion was not reported on the list of the top 200 chemicals involved in human incidents.

Handler Exposures & Assumptions

EPA has determined that there are potential exposures to mixers, loaders, applicators, and other handlers during usual use-patterns associated with methyl parathion. Based on the use patterns, ten major exposure scenarios were identified for methyl parathion: (1a) mixing/loading liquids (emulsifiable concentrate) for aerial application; (1b) mixing/loading liquids (emulsifiable concentrate) for groundboom application; (1c) mixing/loading liquids (emulsifiable concentrate) for airblast application; (2a) mixing/loading liquids (microencapsulated) for aerial/chemigation application; (2b) mixing/loading liquids (microencapsulated) for groundboom application; (2c) mixing/loading liquids (microencapsulated) for airblast application (3a) loading granulars for tractor-drawn/mechanical spreader application; (3b) loading granulars for aerial application; (4a) applying sprays with a fixed-wing aircraft; (4b) applying granulars with a fixed-wing aircraft; (5) applying sprays with a helicopter; (6) applying sprays with groundboom equipment; (7) applying sprays with airblast equipment; (8) applying granulars with a tractor-drawn spreader; (9) flagging aerial spray applications; and (10) flagging aerial granular applications.

Short-term and intermediate-term exposures and doses at baseline (developed using PHED Version 1.1 surrogate data) are presented in Table 1. No chemical-specific handler data were submitted. Table 2 presents the short-term total baseline and short-term MOEs with mitigation methods to handlers. Table 3 presents the intermediate-term total baseline MOEs combined with mitigation measures to handlers. Table 4 summarizes the caveats and parameters specific to each exposure scenario and corresponding risk assessment.

The following general assumptions are made:

- Average body weight of an adult handler is 70 kg.

- Average work day interval represents an 8 hour workday (e.g., the acres treated or volume of spray solution prepared in a typical day).

- Calculations of handler scenarios are completed using the application rates recommended by the available methyl parathion labels and the LUIS reports. The various crop groupings found in the application rate column of the tables (i.e., vegetables, fruits, cotton, pasture, rice, etc.) are assigned in a way to try to simplify the exposure considerations found for the pesticide use of this chemical. The crop

groupings are developed based on different ranges of application rates, formulations of the end-use product, selection of pests, and different exposure considerations.

- PHED Version 1.1 data were used for to estimate exposures for all scenarios.[4]

- Due to a lack of scenario-specific data, HED calculated unit exposure values using generic data from the Pesticide Handler Exposure Database (PHED) and, in lieu of PHED data for a scenario, using protection factors that are applied to represent various risk mitigation options (i.e., the use of PPE and engineering controls). See Table 4 for details.

- Area treated in each scenario: 350 acres for aerial and chemigation applications (including flaggers supporting aerial applications); 80 acres for groundboom applications and for tractor-drawn/mechanical granule spreaders; 40 acres for airblast application.

- The labels indicates using a ground or aerial sprayer for field-grown ornamentals. Exposure and risk assessments for handheld equipment were not conducted.

- No PHED data were available for microencapsulant formulations; therefore, PHED data for liquids was used as a surrogate for this formulation.

Potential daily dermal exposure is calculated using the following formula:

$$Daily\ Dermal\ Exposure\left(\frac{mg\ ai}{day}\right) = Unit\ Exposure\left(\frac{mg\ ai}{lb\ ai}\right) \times Use\ Rate\left(\frac{lb\ ai}{A}\right) \times Daily\ Acres\ Treated\left(\frac{A}{day}\right)$$

A 100 percent dermal absorption value is assumed.

Potential daily inhalation exposure is calculated using the following formula:

$$Daily\ Inhalation\ Exposure\left(\frac{mg\ ai}{day}\right) =$$
$$Unit\ Exposure\left(\frac{\mu g\ ai}{lb\ ai}\right) \times Conversion\ Factor\left(\frac{1mg}{1{,}000\ \mu g}\right) \times Use\ Rate\left(\frac{lb\ ai}{A}\right) \times Daily\ Acres\ Treated\left(\frac{A}{day}\right)$$

The daily dermal and inhalation dose is calculated using a 70 kg body weight for both short-term and intermediate-term exposure as follows:

$$Daily\ Inhalation\ Dose\left(\frac{mg\ ai}{kg/day}\right) = Daily\ Inhalation\ Exposure\left(\frac{mg\ ai}{day}\right) \times \left(\frac{1}{Body\ Weight\ (kg)}\right)$$

$$Daily\ Dermal\ Dose\left(\frac{mg\ ai}{Kg/Day}\right) = Daily\ Dermal\ Exposure\left(\frac{mg\ ai}{Day}\right) x \left(\frac{1}{Body\ Weight\ (Kg)}\right)$$

$$Total\ Daily\ Dose = Daily\ Dermal\ Dose\left(\frac{mg}{kg/day}\right) + Daily\ Inhalation\ Dose\left(\frac{mg}{kg/day}\right)$$

These calculations of both the daily dermal dose and the daily inhalation dose of methyl parathion received by handlers are used to assess the total dermal risk to handlers. The short-term and intermediate-term total MOE were calculated using a NOEL of 0.025 mg/kg/day and a NOEL of 0.02 mg/kg/day, respectively. The following formula describes the calculation of a total MOE:

$$Total\ MOE = \frac{NOEL\left(\frac{mg}{kg/day}\right)}{Total\ Daily\ Dose\left(\frac{mg}{kg/day}\right)}$$

Table 1. Occupational Short-Term and Intermediate-Term Dermal and Inhalation Exposure to Methyl Parathion and Doses at Baseline.

Exposure Scenario (Scans #)	Baseline Dermal Unit Exposure (mg/lb ai)[a]	Baseline Inhalation Unit Exposure (ug/lb ai)[b]	Maximum Application Rate (lb ai/acre)[c]	Daily Acres Treated[d]	Daily Dermal Exposure (mg/day)[e]	Daily Inhalation Exposure (mg/day)[f]	Baseline Dermal Dose (mg/kg/day)[g]	Baseline Inhalation Dose (mg/kg/day)[h]	Baseline Total Daily Dose (mg/kg/day)[I]
Mixer/Loader Exposure									
Mixing/Loading Liquids (emulsifiable concentrate) for Aerial Application (1a)	2.9	1.2	(1) 0.1 pastures	350	100	0.042	1.4	0.00060	1.4
			(2) 1.0 veg. & orn.		1,000	0.42	14	0.0060	14
			(3) 3.0 cotton		3,000	1.3	43	0.018	43
Mixing/Loading Liquids (emulsifiable concentrate) for Groundboom Application (1b)			(1) 0.1 pastures	80	23	0.0096	0.33	0.00014	0.33
			(2) 1.0 veg.		230	0.096	3.3	0.0014	3.3
			(3) 3.0 cotton		700	0.29	10	0.0041	10
Mixing/Loading Liquids (emulsifiable concentrate) for Airblast Sprayer (1c)			(4) 1.0 fruit	40	120	0.048	1.7	0.00069	1.7
Mixing/Loading Liquids (microencapsulated) for Aerial/Chemigation Application (2a)	2.9	1.2	(2) 1.0 veg.	350	1,000	0.42	14	0.0060	14
			(5) 3.0 grapes		3,000	1.3	43	0.018	43
Mixing/Loading Liquids (microencapsulated) for Groundboom Application (2b)			(2) 1.0 veg.	80	230	0.096	3.3	0.0014	3.3
			(5) 3.0 grapes		700	0.29	10	0.0041	10
Mixing/Loading Liquids (microencapsulated) for Airblast Sprayer (2c)			(4) 1.0 fruit	40	120	0.048	1.7	0.00069	1.7
Loading Granulars for Tractor Drawn/Mechanical Spreader Application (3a)	0.0076	1.7	(1) 0.1 pastures	80	0.060	0.014	0.00086	0.00019	0.0011
Loading Granulars for Aerial Application (3b)				350	0.27	0.060	0.0039	0.00085	0.0048

Table 1. Occupational Short-Term and Intermediate-Term Dermal and Inhalation Exposure to Methyl Parathion and Doses at Baseline (continued)

Exposure Scenario (Scans #)	Baseline Dermal Unit Exposure (mg/lb ai)[a]	Baseline Inhalation Unit Exposure (ug/lb ai)[b]	Maximum Application Rate (lb ai/acre)[c]	Daily Acres Treated[d]	Daily Dermal Exposure (mg/day)[e]	Daily Inhalation Exposure (mg/day)[f]	Baseline Dermal Dose (mg/kg/day)[g]	Baseline Inhalation Dose (mg/kg/day)[h]	Baseline Total Daily Dose (mg/kg/day)[i]
Applicator Exposure									
Applying Liquids with Fixed-wing Aircraft (4a)	See Engineering Controls	See Engineering Controls	(1) 0.1 pastures	350	See Engineering Controls	See Engineering Controls	See Engineering Controls	See Engineering Controls	See Engineering Controls
			(2) 1.0 veg & orn						
			(3) 3.0 cotton & (5) grapes						
Applying Granular with a Fixed-Wing Aircraft (4b)	See Engineering Controls	See Engineering Controls	(1) 0.1 pastures	350	See Engineering Controls	See Engineering Controls	See Engineering Controls	See Engineering Controls	See Engineering Controls
Applying Liquids with a Helicopter (5)	See Engineering Controls	See Engineering Controls	(1) 0.1 pastures	350	See Engineering Controls	See Engineering Controls	See Engineering Controls	See Engineering Controls	See Engineering Controls
			(2) 1.0 veg. & orn.						
			(3) 3.0 cotton and (5) grapes						
Applying Liquids with a Groundboom Sprayer (6)	0.015	0.7	(1) 0.1 pastures	80	0.12	0.0056	0.0017	0.000080	0.0018
			(2) 1.0 veg. & orn.		1.2	0.056	0.017	0.00080	0.018
			(3) 3.0 cotton and (5) grapes		3.6	0.17	0.051	0.0024	0.053
Applying Sprays with an Airblast Sprayer (7)	0.36	4.5	(1) 1.0 fruit	40	14	0.18	0.20	0.0026	0.20
Applying Granulars with a Tractor-drawn Spreader (8)	0.0099	1.2	(1) 0.1 pastures	80	0.079	0.0096	0.0011	0.000014	0.0012

Table 1. Occupational Short-Term and Intermediate-Term Dermal and Inhalation Exposure to Methyl Parathion and Doses at Baseline (continued)

Exposure Scenario (Scans #)	Baseline Dermal Unit Exposure (mg/lb ai)[a]	Baseline Inhalation Unit Exposure (ug/lb ai)[b]	Maximum Application Rate (lb ai/acre)[c]	Daily Acres Treated[d]	Daily Dermal Exposure (mg/day)[e]	Daily Inhalation Exposure (mg/day)[f]	Baseline Dermal Dose (mg/kg/day)[g]	Baseline Inhalation Dose (mg/kg/day)[h]	Baseline Total Daily Dose (mg/kg/day)[I]
Flagger Exposure									
Flagging Aerial Spray Applications (9)	0.01	0.28	(1) 0.1 pastures	350	0.35	0.0098	0.0050	0.00014	0.0051
			(2) 1.0 veg. & orn.		3.5	0.0098	0.050	0.0014	0.051
			(3) 3.0 cotton and (5) grapes		11	0.29	0.16	0.0042	0.16
Flagging Aerial Granular Applications (10)	0.0025	0.15	(1) 0.1 pastures	350	0.088	0.0053	0.0013	0.000075	0.0014

[a] Baseline dermal unit exposure represents long pants, long sleeved shirt, no gloves, open mixing/loading, open cab tractor. Baseline data are not available for aerial.

[b] Baseline inhalation exposure represents no respirator.

[c] Application rates are a range of representative and maximum rates values found in the methyl parathion labels. According to methyl parathion labels, the maximal seasonal rate for methyl parathion is 3 lb ai/A and representative rates include:
(1) 0.1 lb ai/acre for pastures and nonagricultural wasteland for mosquito control, which is available as an emulsifiable concentrate; EPA Reg 9779-34, 5905-55, and a granular formulation EPA Reg. 5481-330.
(2) 1.0 lb ai/acre (veg.) for food, feed, and forage crops (i.e., alfalfa, almonds, apples, barley, spinach, etc.), which is available as an emulsifiable concentrate; EPA Regs 67760-29, 5905-528, 279-2609, 6905-55, and a microencapsulated; EPA Reg. 4581-292. In addition, ornamental (orn.) uses are also included; EPA Reg 5905-55 and 9779-34.
(3) 3.0 lb ai/acre (cotton) for cotton, which is available only in an emulsifiable concentrate; EPA Reg. 279-2149, 279-2609, 2935-421, etc.
(4) 1.0 lb ai/acre (fruit) for apples, nectarines, peaches, and plums, etc., which is available in an emulsifiable concentrate EPA Reg 9779-34 and a microencapsulated formulation; EPA Reg. 4581-292.
(5) 3.0 lb ai/acre for grapes, which is available in a microencapsulated formulation; EPA Reg. 4581-292.

[d] Daily acres treated values are from the EPA HED estimates of acreage that could be treated in a single day for each exposure scenario of concern.

[e] Daily dermal exposure (mg/day) = Exposure (mg/lb ai) * Application rate (lb ai/acre) * Acres treated (acres/day).

[f] Daily inhalation exposure (mg/day) = Exposure (µg/lb ai) * (1mg/1000 µg) Conversion factor * Application rate (lb ai/A) * Acres treated (acres/day).

[g] Baseline dermal dose (mg/kg/day) = Daily dermal exposure / Body weight (70 kg).

[h] Baseline inhalation dose (mg/kg/day) = Daily inhalation exposure / Body weight (70 kg).

[I] Baseline total daily dose (mg/kg/day) = Baseline daily dermal dose (mg/kg/day) + Baseline inhalation dose (mg/kg/day).

Table 2. Occupational Short-term Combined Inhalation and Dermal MOEs for Methyl Parathion at Baseline and with Mitigation Measures for Occupational Exposures.

Exposure Scenario (Scenario #)	Total Baseline MOE[a]	Additional Mitigation Measures									
		Additional PPE[b]				Engineering Controls[d]					
		Unit Dermal Exposure (mg/lb ai)	Daily Dermal Dose[b] (mg/kg/day)	Total Daily Dose (dust/mist respirator, 5-fold PF)[c] (mg/kg/day)*	Total MOE[a]	Unit Dermal Exposure (mg/lb ai)	Daily Dermal Dose[b] (mg/kg/day)	Unit Inhalation Exposure (μg/lb ai)	Daily Inhalation Dose[d] (mg/kg/day)	Total Daily Dose[e] (mg/kg/day)	Total MOE[a]
Mixer/Loader Exposure and Dose Levels											
Mixing/Loading Liquids (emulsifiable concentrate) for Aerial Application (1a)	0.017	0.025	0.013	0.013	1.9	0.009 (gloves)	0.0045	0.08	0.000040	0.0045	5.6
	0.0018		0.13	0.13	0.19		0.045		0.00040	0.045	0.56
	0.00058		0.38	0.38	0.066		0.14		0.0012	0.14	0.18
Mixing/Loading Liquids (emulsifiable concentrate) for Groundboom Application (1b)	0.076		0.0029	0.0029	8.6		0.0010		9.1E-06	0.0010	25
	0.0076		0.029	0.029	0.86		0.010		9.1E-05	0.010	2.5
	0.0025		0.086	0.087	0.29		0.031		0.00027	0.031	0.81
Mixing/Loading Liquids (emulsifiable concentrate) for Airblast Sprayer (1c)	0.015		0.014	0.014	1.8		0.0051		0.000046	0.0051	4.9
Mixing/Loading Liquids (microencapsulated) for Aerial/Chemigation Application (2a)	0.0018	0.025	0.13	0.13	0.19	0.009 (gloves)	0.045	0.24	0.00040	0.045	0.56
	0.00058		0.38	0.38	0.66		0.14		0.0012	0.14	0.18
Mixing/Loading Liquids (microencapsulated) for Groundboom Application (2b)	0.0076		0.029	0.029	0.86		0.01		0.000091	0.01	2.5
	0.0025		0.086	0.087	0.29		0.031		0.00027	0.031	0.81
Mixing/Loading Liquids (microencapsulated) for Airblast Sprayer (2c)	0.015		0.014	0.014	1.8		0.0051		0.000046	0.0051	4.9
Loading Granulars for Tractor Drawn/Mechanical Spreader Application (3a)	23	0.0043	0.00049	0.00053	47	0.00017	0.0002	0.034	3.9E-06	0.0002	126
Loading Granulars for Aerial Application (3b)	5.2		0.0022	0.0024	10		0.0009		1.75E-05	0.0009	29

Table 2. Occupational Short-term Combined Inhalation and Dermal MOEs for Methyl Parathion at Baseline and with Mitigation Measures for Occupational Exposures.

Exposure Scenario (Scenario #)	Total Baseline MOE[a]	Additional Mitigation Measures									
		Additional PPE[b]				Engineering Controls[d]					
		Unit Dermal Exposure (mg/lb ai)	Daily Dermal Dose[b] (mg/kg/day)	Total Daily Dose (dust/mist respirator, 5-fold PF)[c] (mg/kg/day)*	Total MOE[a]	Unit Dermal Exposure (mg/lb ai)	Daily Dermal Dose[b] (mg/kg/day)	Unit Inhalation Exposure (μg/lb ai)	Daily Inhalation Dose[d] (mg/kg/day)	Total Daily Dose[e] (mg/kg/day)	Total MOE[a]
Applicator Exposure, Dose, and Risk Levels											
Applying Liquids with Fixed-wing Aircraft (4a)	See Eng. Controls	See Eng. Controls	See Eng. Controls	See Eng. Controls	See Eng. Controls	0.005	0.0025	0.068	0.000034	0.0025	10
							0.025		0.00034	0.025	1.0
							0.075		0.0010	0.076	0.3
Applying Granular with a Fixed-wing Aircraft (4b)	See Eng. Controls	See Eng. Controls	See Eng. Controls	See Eng. Controls	See Eng. Controls	0.0016	0.0008	1.3	0.00066	0.0015	17
Applying Liquids with Helicopter Aircraft (5)	See Eng. Controls	See Eng. Controls	See Eng. Controls	See Eng. Controls	See Eng. Controls	0.0021	0.0011	0.0018	9.0E-07	0.0011	23
							0.011		9.0E-06	0.011	2.3
							0.032		2.7E-05	0.032	0.80
Applying Liquids with a Groundboom Sprayer (6)	14	0.01	0.0011	0.0011	23	0.0067	0.00077	0.043	4.9E-06	0.00078	32
	1.4		0.011	0.011	2.3		0.0077		4.9E-05	0.0078	3.2
	0.47		0.034	0.034	0.74		0.023		0.00096	0.024	1.0
Applying Liquids Using an Airblast Sprayer (7)	0.13	0.121	0.069	0.070	0.36	0.016 (gloves)	0.0090	0.4	0.00023	0.0092	2.7
Applying Granulars with a Tractor-drawn Spreader (8)	21	0.004	0.00046	0.00049	51	0.0021	0.00024	0.22	0.000025	0.00027	93
Flagger Exposure, Dose, and Risk Levels											
Flagging Aerial Spray Applications (9)	4.9	0.007	0.0035	0.0035	7.1	0.0002	0.00010	0.007	3.5E-06	0.0001	241
	0.49		0.035	0.035	0.71		0.0010		3.5E-05	0.001	24
	0.16		0.11	0.11	0.23		0.0030		0.00011	0.003	8.1
Flagging Aerial Granular Applications (10)	18	0.0013	0.00065	0.00067	37	0.000056	0.000028	0.003	1.5E-06	0.00003	847

a Total MOE = Short-term NOEL (0.025 mg/kg/day) / Total daily dose.

b PPE/Engineering daily absorbed dermal dose (mg/kg/day) = [Dermal unit exposure (mg/lb ai) x Maximum application rate (lb ai/acre) x Daily acres treated}] / 70 Kg

c PPE Total daily dose = PPE daily absorbed dermal dose (mg/kg/day) + (Baseline daily inhalation dose (mg/kg/day) / 5)[for 80 percent PF].

d Daily inhalation dose (mg/kg/day) = [Inhalation unit exposure (μg/lb ai) x Conversion factor $\left(\frac{1\ \text{mg}}{1{,}000\ \mu\text{g}}\right)$ x Maximum application rate (lb ai/acre) x Daily acres treated] / 70 kg.

e Total daily dose (mg/kg/day) = Engineering daily dermal dose (mg/kg/day) + Engineering daily inhalation dose (mg/kg/day).

Table 3. Occupational Intermediate-term Combined Inhalation and Dermal MOEs for Methyl Parathion at Baseline and with Mitigation Measures for Occupational Exposures.

Exposure Scenario (Scenario. #)	Total MOE[a]	Additional Mitigation Measures									
		Additional PPE[b]				Engineering Controls[d]					
		Unit Dermal Exposure (mg/lb ai)	Daily Dermal Dose[b] (mg/kg/day)	Total Daily Dose (dust/mist respirator, 5-fold PF)[c] (mg/kg/day)*	Total MOE[a]	Unit Dermal Exposure (mg/lb ai)	Daily Dermal Dose[b] (mg/kg/day)	Unit Inhalation Exposure (μg/lb ai)	Daily Inhalation Dose[d] (mg/kg/day)	Total Daily Dose[e] (mg/kg/day)	Total MOE[a]
Mixer/Loader Exposure, Dose, and Risk Levels											
Mixing/Loading Liquids (emulsifiable concentrate) for Aerial Application (1a)	0.014	0.025	0.013	0.013	1.5	0.009 (gloves)	0.0045	0.08	0.000040	0.0045	4.4
	0.0014		0.13	0.13	0.15		0.045		0.00040	0.045	0.44
	0.00047		0.38	0.38	0.05		0.14		0.0012	0.14	0.14
Mixing/Loading Liquids (emulsifiable concentrate) for Groundboom Application (1b)	0.061		0.0029	0.0029	6.9		0.0010		9.1E-06	0.0010	20
	0.0061		0.029	0.029	0.69		0.010		9.1E-05	0.010	2
	0.002		0.086	0.087	0.23		0.031		0.00027	0.031	0.65
Mixing/Loading Liquids (emulsifiable concentrate) for Airblast Sprayer (1c)	0.012		0.014	0.014	1.4		0.0051		0.000046	0.0051	3.9
Mixing/Loading Liquids (microencapsulated) for Aerial/Chemigation Application (2a)	0.0014	0.025	0.13	0.13	0.15	0.009 (gloves)	0.045	0.24	0.00040	0.045	0.44
	0.0005		0.38	0.38	0.05		0.14		0.0012	0.14	0.14
Mixing/Loading Liquids (microencapsulated) for Groundboom Application (2b)	0.0061		0.029	0.029	0.69		0.01		0.000091	0.01	2
	0.0020		0.086	0.087	0.23				0.00027	0.031	0.65
Mixing/Loading Liquids (microencapsulated) for Airblast Sprayer (2c)	0.012		0.014	0.014	1.4		0.0051		0.000046	0.0051	3.9
Loading Granulars for Tractor Drawn/Mechanical Spreader Application (3a)	18	0.0043	0.00049	0.00053	37	0.017	0.0002	0.034	3.9E-06	0.0002	101
Loading Granulars for Aerial Application (3b)	4.2		0.0022	0.0024	8		0.0009		1.7E-05	0.0009	23

Table 3. Occupational Intermediate-term Combined Inhalation and Dermal MOEs for Methyl Parathion at Baseline and with Mitigation Measures for Occupational Exposures.

Exposure Scenario (Scenario. #)	Total MOE[a]	Additional Mitigation Measures									
		Additional PPE[b]				Engineering Controls[d]					
		Unit Dermal Exposure (mg/lb ai)	Daily Dermal Dose[b] (mg/kg/day)	Total Daily Dose (dust/mist respirator, 5-fold PF)[c] (mg/kg/day)*	Total MOE[a]	Unit Dermal Exposure (mg/lb ai)	Daily Dermal Dose[b] (mg/kg/day)	Unit Inhalation Exposure (μg/lb ai)	Daily Inhalation Dose[d] (mg/kg/day)	Total Daily Dose[e] (mg/kg/day)	Total MOE[a]
Applicator Exposure, Dose, and Risk Levels											
Applying Liquids with Fixed-wing Aircraft (4a)	See Eng. Controls	See Eng. Controls	See Eng. Controls	See Eng. Controls	See Eng. Controls	0.005	0.0025	0.068	0.000034	0.0025	8
							0.025		0.00034	0.025	0.8
							0.075		0.0010	0.076	0.26
Applying Granular with a Fixed-wing Aircraft (4b)	See Eng. Controls	See Eng. Controls	See Eng. Controls	See Eng. Controls	See Eng. Controls	0.0016	0.0008	1.3	0.00066	0.0015	13
Applying Liquids with Helicopter Aircraft (5)	See Eng. Controls	See Eng. Controls	See Eng. Controls	See Eng. Controls	See Eng. Controls	0.0021	0.0011	0.0018	9.0E-07	0.0011	18
							0.011		9.0E-06	0.011	1.8
							0.032		2.7E-05	0.032	0.63
Applying Liquids with a Groundboom Sprayer (6)	11	0.01	0.0011	0.0011	18	0.0067	0.00077	0.043	4.9E-06	0.00078	32
	1.1		0.011	0.011	1.8		0.0077		4.9E-05	0.0078	3.2
	0.38		0.034	0.034	0.59		0.023		0.00096	0.024	0.83
Applying Liquids Using an Airblast Sprayer (7)	0.10	0.121	0.069	0.070	0.29	0.016 (gloves)	0.0090	0.4	0.00023	0.0092	2.2
Applying Granulars with a Tractor-drawn Spreader (8)	17	0.004	0.00046	0.00049	41	0.0021	0.00024	0.22	0.000025	0.00027	74
Flagger Exposure, Dose, and Risk Levels											
Flagging Aerial Spray Applications (9)	3.9	0.007	0.0035	0.0035	5.7	0.0002	0.00010	0.007	3.5E-06	0.0001	193
	0.39		0.035	0.035	0.57		0.0010		3.5E-05	0.001	19
	0.13		0.11	0.11	0.18		0.0030		0.00011	0.003	6.4
Flagging Aerial Granular Applications (10)	14	0.0013	0.00065	0.00067	30	0.000056	0.000028	0.003	1.5E-06	0.0003	678

a Total MOE = Intermediate-term NOEL (0.02 mg/kg/day) / Total daily dose.
b PPE/Engineering daily absorbed dermal dose (mg/kg/day)= [Dermal unit exposure (mg/lb ai) x Maximum application rate (lb ai/acre) x Daily acres treated] / 70 Kg
c PPE Total daily dose = PPE daily absorbed dermal dose (mg/kg/day) + (Baseline daily inhalation dose (mg/kg/day)) / 5 [for 80 percent PF].
d Daily inhalation dose (mg/kg/day) = [Inhalation unit exposure (μg/lb ai) x Maximum application rate (lb ai/acre) x Daily acres treated.] / 70 kg.
e Total daily dose (mg/kg/day) = Engineering daily dermal dose (mg/kg/day) + Engineering daily inhalation dose (mg/kg/day).

Table 4: Occupational Exposure Scenario Descriptions for the Use of Methyl Parathion

Exposure Scenario (Number)	Data Source	Standard Assumptions[a] (8-hr work day)	Comments[b]
Mixer/Loader Exposure			
Mixing/Loading Liquid Formulations (1 a, 1b, and 1c) (emulsifiable concentration formulation)	PHED V1.1	350 acres for aerial, 80 acres for groundboom, and 40 acres for airblast.	**Baseline:** "Best Available" grades: Hands, dermal, and inhalation based on acceptable grades. Dermal = 25 to 122 replicates; hands = 53 replicates; and inhalation= 85 replicates. High confidence in all data. **PPE:** "Best Available" grades: Hands, dermal, and inhalation = acceptable grades. Dermal = 25 to 122 replicates; hands = 59 replicates; and inhalation = 85 replicates. High confidence in all data. **Engineering Controls:** "Best Available" grades: Hands, dermal, and inhalation = acceptable grades; Dermal = 16 to 22 replicates; hands = 31 replicates; and inhalation = 27 replicates. High confidence in all data. PHED data were used for baseline, no protection factors (PFs) were necessary. A 50% PF was added to simulate coveralls for PPE. An 80% PF was used for PPE for inhalation to represent a dust/mist respirator. Engineering Controls data were monitored with chemical resistant gloves.
Mixing/Loading Liquid Formulations (2a, 2b, 2c) (microencapsulated formulation)	PHED V1.1	350 acres for aerial and chemigation, 80 acres for groundboom, and 40 acres for airblast.	**Baseline:** "Best Available" grades: Hands, dermal, and inhalation based on acceptable grades. Dermal = 25 to 122 replicates; hands = 53 replicates; and inhalation= 85 replicates. High confidence in all data. **PPE:** "Best Available" grades: Hands, dermal, and inhalation = acceptable grades. Dermal = 25 to 122 replicates; hands = 59 replicates; and inhalation = 85 replicates. High confidence in all data. **Engineering Controls:** "Best Available" grades: Hands, dermal, and inhalation = acceptable grades; Dermal = 16 to 22 replicates; hands = 31 replicates; and inhalation = 27 replicates. High confidence in all data. PHED data were used for baseline, no protection factors (PFs) were necessary. A 50% PF was added to simulate coveralls for PPE. An 80% PF was used for PPE for inhalation to represent a dust/mist respirator. Engineering Controls data were monitored with chemical resistant gloves. No PHED data was available for microencapsulate formulations; therefore, PHED for liquids was used as a surrogate.
Mixing/Loading Granulars (3a and 3b)	PHED V1.1	80 acres for tractor drawn/mechanical spreaders, and 350 acres for aerial	**Baseline:** "Best Available" grades: Dermal and inhalation = acceptable grades; and hands = all grades. Dermal = 29 to 36 replicates; hands = 10 replicates; and inhalation = 58 replicates. Low confidence in dermal and gloves. High confidence in inhalation data. **PPE:** "Best Available" grades: Hands and inhalation = acceptable grades; Dermal = A,B,C, grades. Dermal = 12 to 59 replicates; hands = 45 replicates; and inhalation = 58 replicates. Low confidence in dermal and hands data. High confidence in inhalation data. **Engineering Controls:** Dermal=A,B,C grades; hands=All grades, inhalation = A, B grades. Dermal = 33 to 78 replicates; hands = 10 replicates; inhalation = 58 replicates. Low confidence in dermal and hand data, high confidence in inhalation data. PHED data were used for baseline data. An 80% PF was used for PPE for inhalation to represent a dust/mist respirator. PPE assumes coveralls over long-sleeve shirt, long pants, and gloves for dermal. No PF needed. Engineering controls are “Lock and Load” containers.

Table 4: Occupational Exposure Scenario Descriptions for the Use of Methyl Parathion (continued)

Exposure Scenario (Number)	Data Source	Standard Assumptions[a] (8-hr work day)	Comments[b]
Applicator Exposure			
Applying Liquids with a Fixed-wing Aircraft Application (4a)	PHED V1.1	350 acres	**Engineering controls:** "Best Available" grades: Dermal and inhalation = ABC grades; and hands = acceptable grades. Dermal = 24 to 48 replicates; hands = 34 replicates; and inhalation = 23 replicates. Medium confidence in all data. PHED data were used for baseline, no PFs were necessary.
Applying Granulars with a Fixed-wing Aircraft (4b)	PHED V1.1	350 acres	**Engineering Controls:** "Best Available" grades: Hands = all grades; dermal = C grade; and inhalation = all grades. Hands = 4 replicates; dermal = 9 to 13 replicates; and inhalation = 13 replicates. Low confidence in dermal and inhalation data. PHED data used, no PFs necessary.
Helicopter Application (5)	PHED V1.1	350 acres	**Engineering Controls:** "Best Available" grades: Dermal and hands = ABC grades; and inhalation = acceptable grades. Dermal = 3 replicates; hands = 2 replicates; and inhalation = 3 replicates. Low confidence in all data. PHED data were used for baseline, no PFs were necessary.
Groundboom Application (6)	PHED V1.1	80 acres	**Baseline:** "Best Available" grades: Hands and dermal, and inhalation = acceptable grades. Dermal = 32 to 42 replicates; hands = 29 replicates; and inhalation = 22 replicates. High confidence in all data. **PPE:** "Best Available" grades: Dermal and inhalation= acceptable grades; hands = ABC grades. Dermal = 32 to 42 replicates; hands = 21 replicates; and inhalation= 22 replicates. Medium confidence in dermal and hands data. High confidence in inhalation data. **Engineering Controls:** "Best Available" grades: Dermal and hands = ABC grades. Dermal = 20 to 31 replicates; hands = 16 replicates. Medium confidence in dermal and hands data. High confidence in inhalation data. PHED data were used for baseline, no PFs were necessary. A 50% PF was added to the PPE scenario only to simulate coveralls.
Applying Liquids with an Airblast Sprayer (7)	PHED V1.1	40 acres	**Baseline:** "Best Available" grades = Hands, dermal, and inhalation = acceptable grades. Dermal = 32 to 49 replicates; hands = 22 replicates; and inhalation = 47 replicates. High confidence in all data. **PPE:** "Best Available" grades = Hands, dermal, and inhalation = acceptable grades. Dermal = 32 to 49 replicates; hands = 18 replicates; and inhalation = 47 replicates. High confidence in all data. **Engineering Controls:** "Best Available" grades: Hands and dermal = acceptable grades; and inhalation= ABC grades. Dermal = 20 to 30 replicates; hands = 20 replicates; and inhalation = 9 grades. High confidence in dermal data. Low confidence in inhalation data. No PFs were used for baseline data. A 50 percent PF was used for PPE to simulate coveralls. Engineering Controls data were monitored with chemical resistant gloves. 80% PF for the addition of a dust/mist respirator.

Table 4: Occupational Exposure Scenario Descriptions for the Use of Methyl Parathion (continued)

Exposure Scenario (Number)	Data Source	Standard Assumptions[a] (8-hr work day)	Comments[b]
Applying Granular Formulations With a Tractor-drawn Spreader (8)	PHED V1.1	80 acres	**Baseline:** "Best Available" grades: Hands, dermal, and inhalation = A,B grades. Hands = 5 replicates; dermal = 1 to 5 replicates; and inhalation = 5 replicates. Low confidence in dermal, hands, and inhalation data. **PPE:** "Best Available" grades: Hands, dermal, and inhalation = A,B, grades. Hands = 5 replicates; dermal = 1 to 5 replicates; and inhalation = 5 replicates. Low confidence in dermal, hands, and inhalation data. **Engineering Controls:** "Best Available" grades: Hands, dermal, and inhalation = A,B, grade. Hands = 24 replicates; dermal = 2 to 30 replicates; and inhalation = 37 replicates. Low confidence in hands and dermal data. High confidence in inhalation data. No PFs were used for baseline although baseline data were monitored with chemical resistant gloves. A 50 percent PF was used for PPE to simulate coveralls. A reverse 90 percent PF was back calculated for gloves. All PHED data derived from PHED Surrogate Guide.
Flagger Exposure			
Flagging Aerial Spray Applications	PHED V1.1	350 acres	**Baseline:** "Best Available" grades: Hands, dermal, and inhalation = acceptable grades. Hands = 16 replicates; dermal = 16 to 18 replicates; and inhalation = 18 replicates. High confidence in dermal, hands, and inhalation data. **PPE:** "Best Available" grades: Hands, dermal, and inhalation = acceptable grades. Hands = 2 replicates; dermal = 16 to 18 replicates; and inhalation = 18 replicates. High confidence in dermal and inhalation data. Low confidence in hands data. **Engineering Controls:** Same as baseline. PHED data were used for baseline, no PFs were necessary. A 50% PF was added for PPE to represent coveralls. 80% PF for addition of a dust/mist respirator. A 98 percent PF was applied to baseline to simulate engineering controls.
Flagger Aerial Granular Applications	PHED V1.1	350 acres	**Baseline:** "Best Available" grades: Hands and dermal = acceptable grades. Dermal = 16 to 20 replicates; hands = 4 replicates; inhalation = 4 replicates. High confidence in all data. **PPE:** Same as baseline. **Engineering Controls:** Dermal = A,B,C grades; hands = All grades; inhalation = E grades**.** Dermal= 16 to 20 replicates, hands and inhalation = 4 replicates. Low confidence in all data. A 50 percent PF was applied to total deposition to simulate baseline. A 50 % PF was added for coveralls for PPE. A 98 percent PF was applied to baseline to simulate engineering controls.

[a] Standard Assumptions based on an 8-hour work day as estimated by EPA. BEAD data were not available.

[b] "Best Available" grades are defined by EPA SOP for meeting Subdivision U Guidelines. Acceptable grades are matrices with grades A and B data. Data confidence are assigned as follows:

High = grades A and B and 15 or more replicates
Medium = grades A, B, and C and 15 or more replicates
Low = grades A, B, C, D, and E or any combination of grades with less than 15 replicates

Post Application:

Chemical-specific postapplication exposure and/or environmental fate data have not yet been submitted by the registrant in support of reregistration of all formulation types of methyl parathion. In lieu of these data, a surrogate rangefinder postapplication assessment was conducted to determine potential risks for the representative crops used in the handler exposure assessment section. The surrogate assessment in Table 5 is based on the minimum and maximum application rates of 0.1 lb ai/A for pastures and 3.0 lb ai/A for grapes.

The surrogate assessment measures the minimum and maximum application rates for the use of this product according to application rates found on the methyl parathion labels. The surrogate assessment uses a typical transfer coefficient (Tc) for relatively low postapplication exposure to workers (i.e., Tc = 500 cm^2/hr), from activities such as hoeing, and high postapplication exposure to workers (i.e., Tc = 20,000 cm^2/hr), from activities such as girdling of grapes. The DFR is derived from the various application rates using an estimated 20 percent of the rate applied as initial dislodgeable residues, and an estimated 25 percent dissipation rate per day. While the dissipation half-life of the emulsifiable concentrate is approximately 1 hour, the half-life for the microencapsulated formulation is 1 to 2 days (based on enviromental fate data supplied by EFED). A half-life of 1 to 2 days has also been suggested for the oxon of methyl parathion, depending upon the crop and climate.[5] The estimated dissipation rate of 25 percent per day is intended to approximate this half-life. The equations used for the calculations in Table 5 are presented below:

$$DFR\left(\frac{\mu g}{cm^2}\right) = AR\left(\frac{lb\ ai}{A}\right) \times CF\left(\frac{\mu g/cm^2}{lb\ ai/A}\right) \times F \times (1-DR)^t$$

Where:
AR = Application rate is 0.1 lb ai/A for pastures and 3.0 lb/A for grapes
DR = Daily dissipation rate (25 percent / day)
t = Days after treatment
CF = Conversion factor (11.2 lb per cm^2/lb per A)
F = Fraction retained on foliage (20 percent)

$$Dose\ (mg/kg/d) = \frac{(DFR\ (\mu g/cm^2) \times Tc\ (cm^2/hr) \times CF\left(\frac{1\ mg}{1{,}000\ \mu g}\right) \times Abs \times ED\ (hrs)}{BW\ (kg)}$$

Where:
DFR = Initial DFR or daily DFR (μg/cm^2)
Tc = Transfer coefficient (500 cm^2/hr or 20,000 cm^2/hr)
CF = Conversion factor (1 mg/1,000 μg)

Abs = Dermal absorption (100 percent)
ED = Exposure duration (8 hours per day)
BW = Body weight (70 kg)

$$MOE = \frac{NOEL\ (mg/kg/d)}{Dose\ (mg/kg/d)}$$

Where:
NOEL = 0.02 mg/kg/day
Dose = Calculated dose

Table 5. Methyl Parathion Intermediate-Term Surrogate Postapplication Assessment for Microencapsulated Formulation (Range Finder).

DAT[a]	DFR (µg/cm^2)[b]		Dermal Dose (mg/kg/day)[c]		MOE[d]	
	Min Rate	Max Rate	Min Rate	Min Rate	Min Rate	Max Rate
0	0.22	6.7	0.013	15.4	1.6	0.0013
23	0.0003	0.009	0.00002	0.0005	1200	0.97
48	NA	6.7E-06	NA	3.9E-07	NA	1300

NA = Not applicable
[a] DAT is "days after treatment"
[b] Initial DFR (μg/cm^2) = Application rate (min 0.1 lb ai/A; and max 3.0 lb ai/A) x Conversion factor (1 lb ai/acre= 11.209 ug/cm2) x Fraction of initial ai retained on foliage

$$Daily\ Dissipation\ DFR = AR\left(\frac{lb\ ai}{A}\right) x\ (1 - daily\ DFR)^{(1\ -\ D)^T} x\ CF\left(\frac{\mu g\ per\ cm^2}{lb\ per\ A}\right) x\ FI$$

Where : Assumed percent DFR after initial treatment is 20%, and each day after the percent dissipation per day is 25%.

[c] Dose = DFR (μg/cm^2) x Transfer coefficient (min rate 500, max rate 10,000 cm^2/hr) x Conversion factor (1mg/1000 ug) x Dermal absorption (1) x Hrs worked per day (8 hrs) / Body weight (70 kg)
[d] MOE = NOEL (mg/kg/day) / Dermal dose (mg/kg/day). Where: intermediate NOEL is 0.02 mg/kg/day.

The resulting surrogate postapplication assessment indicates that:

- MOEs equal or exceed 1,000 for crops/activities with a dermal transfer of 500 cm^2/hr at the 23rd day following applications at a rate of 0.1 pounds active ingredient per acre to pastures.

- MOEs equal or exceed 1,000 for crops/activities with a dermal transfer of 20,000 cm^2/hr at the 48th day following applications at a rate of 3.0 pounds active ingredient per acre to grapes.

Based on the findings of the surrogate agricultural assessment, the occupational post-application risks for microencapsulated formulation is of concern. HED should meet with the Registrant to discuss appropriate exposure studies to be submitted.

Combined Dermal and Inhalation Risk from Handler Exposures

Short-Term

Dermal and inhalation exposures were combined and risk was calculated using the short-term dermal NOEL of 0.025 mg/kg/day. The acceptable MOE was assumed to be 1,000.

The calculations of risk based on combined dermal and inhalation exposure indicate that the MOEs are not more than 1,000 even with maximum risk reduction measures for all of the short-term scenarios listed.

Intermediate-Term

Dermal and inhalation exposures were combined and risk was calculated using the intermediate dermal NOEL of 0.02 mg/kg/day. The acceptable MOE was assumed to be 1,000.

The calculations of risk based on combined dermal and inhalation exposure indicate that the MOEs are not more than 1,000 even with maximum risk reduction measures for all of the intermediate-term scenarios listed.

Additional Occupational/Residential Exposure Studies

Handler and Postapplication Studies

The Agency is not aware of additional studies that have been submitted concerning occupational/residential handler exposure and postapplication exposure studies.

References

1) Methyl parathion labels

2) U.S. EPA 1997. Methyl parathion LUIS Table for Exposure Assessors (PRD report dated 7/2/97 and report run date 8/22/97).

3) Methyl parathion (o,o-dimethyl o-p-nitrophenyl phosphorothioate): Hazard Identification Committee Report dated December 1, 1997.

4) Pesticide Handler Exposure Database Version 1.1

5) Popendorf, W. 1985. Reentry Simulation Study, Phase 1. Draft Report.

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OREB files